Control Insect Spruce Budworm

4/14/55

PLAN FOR THE TECHNICAL DIRECTION OF THE 1955 SPRUCE BUDWORM CONTROL PROJECT IN SOUTHERN IDAHO

(came from Mr. Moscrip's office - 5/17/56 -)

By

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Ogden, Utah
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Introduction.

The fir and spruce forests in Idaho have suffered increasingly since 1952 from defoliation caused by the spruce budworm. An appraisal survey conducted in November, 1954 gave indication that the trend of damage is upward. Top killing has already occurred in localized areas. The current infestation covers approximately 1 million acres, of which 666,000 acres have been recommended for spraying in 1955. It is believed that control action would serve to prevent tree mortality, increment loss and bark beetle attacks in trees which will otherwise become seriously weakened by defoliation.

Area to be Sprayed.

The following table contains the area to be sprayed within the indicated National Forests. Approximately 18,000 acres of private ownership is included.

National Forest	Area (ac)
Boise	514,000
Payette	114,000
NezPerce	38,000
Total	666,000

RESPONSIBILITIES OF THE DIVISION OF FOREST INSECT RESEARCH

The following guide is derived from an excellent plan 1/ prepared by Mr. J. M. Whiteside of the Division of Forest Insect Research, Pacific Northwest Forest Experiment Station, Portland, Oregon. Mr. Whiteside has rendered the writer additional assistance concerning equipment, larval instar standards and considerations governing the determination of the start of spraying operations. The job of organizing the technical phases of the 1955 Idaho project would indeed be formidable had it not been for his help.

The Division of Forest Insect Research will not be responsible for the testing of insecticide, or the inspection of planes, pilots and spraying equipment. Those and other operations not covered in the following discussion are the responsibility of National Forest Administration.

TECHNICAL SUPERVISION

Research personnel will determine the timing and sequence of spraying and the mortality after spraying. In addition, Research personnel will assist with the determination of the location of sampling lines along which spray checkers will distribute spray deposit cards.

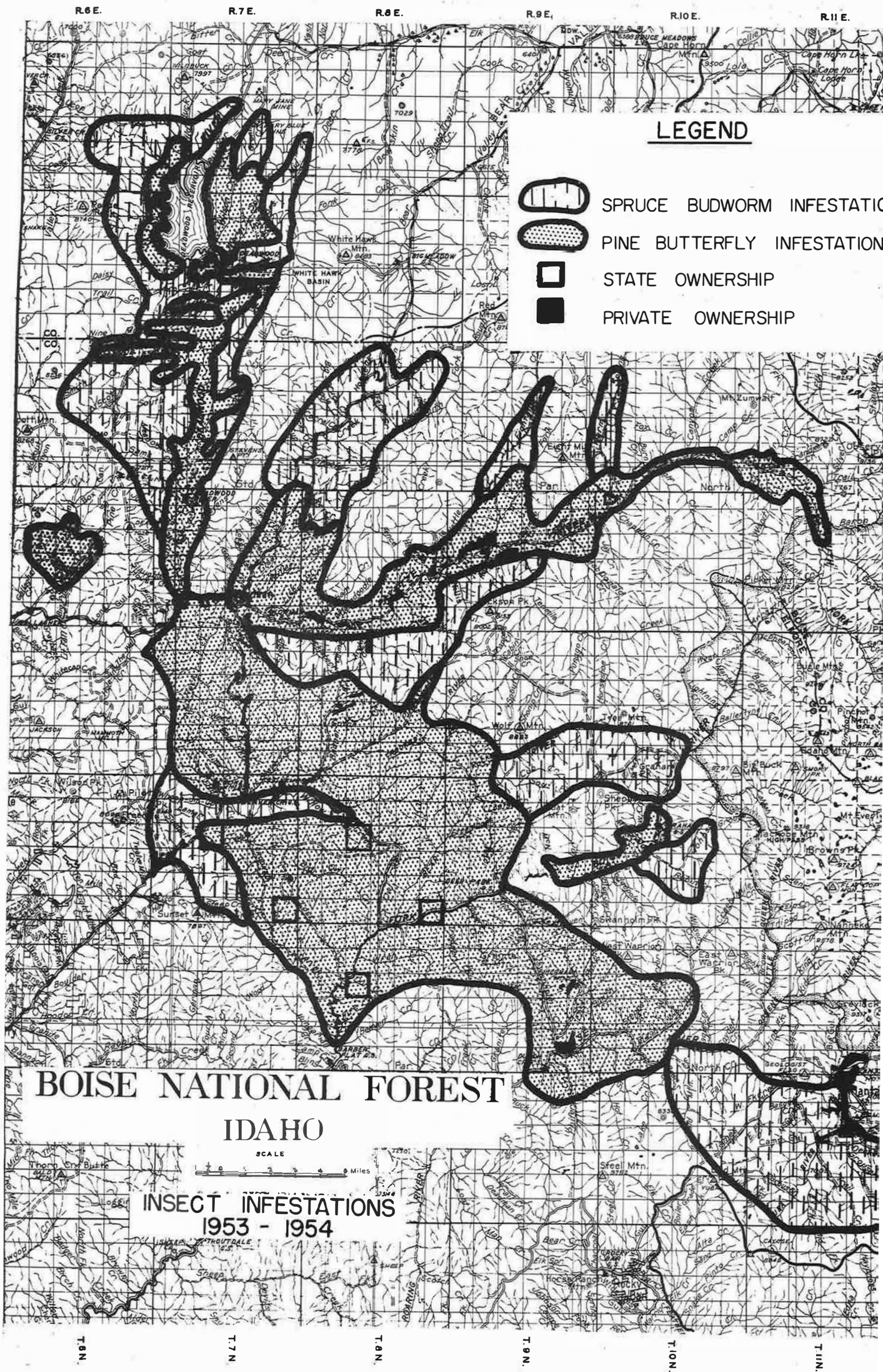
1/ Plan for the Technical Direction of the 1953 Oregon Spruce Budworm Control Project, by J. M. Whiteside. Forest Insect Laboratory, Portland, Ore., April 15, 1953.

The project is divided into four control units (see maps appended). The relationship between the men employed or supervised to some extent by Research, is shown in the following organizational chart.

Technical Director.

Malcolm M. Furniss of the Division of Forest Insect Research will be responsible for the field direction of the technical phases of the project. His primary duties are:

1. To train and be responsible for the work of four Biologists.
2. To coordinate all entomological and phenological data collected by the Biologists and Insect Checkers.
3. To advise the Project Director and Unit Supervisors as to the rate of larval development and the timing and sequence of spraying operations on each control unit. The Biologists will be in the best position to advise the Unit Supervisors as to the daily rate of larval development and the priority of spraying; however, it will be the responsibility of the Technical Director to verify these reports, whenever possible. If possible at least 10 days' notice will be given in writing to the Project Directors of the start of the first spraying operation on each unit so that all planes can be ordered to the unit in advance of the first spraying.
4. To plan and direct field studies to determine larval mortality following spraying operations.
5. To report on the results of spraying operations.


R.6 E.
R.7 E.
R.8 E.
R.9 E.
R.10 E.
R.11 E.
LEGEND
SPRUCE BUDWORM INFESTATIO
PINE BUTTERFLY INFESTATION
STATE OWNERSHIP
PRIVATE OWNERSHIP
BOISE NATIONAL FOREST
IDAHO
SCALE
Miles
INSECT INFESTATIONS
1953 - 1954
T.8 N.
T.7 N.
T.8 N.
T.9 N.
T.10 N.
T.11 N.

T.23N.

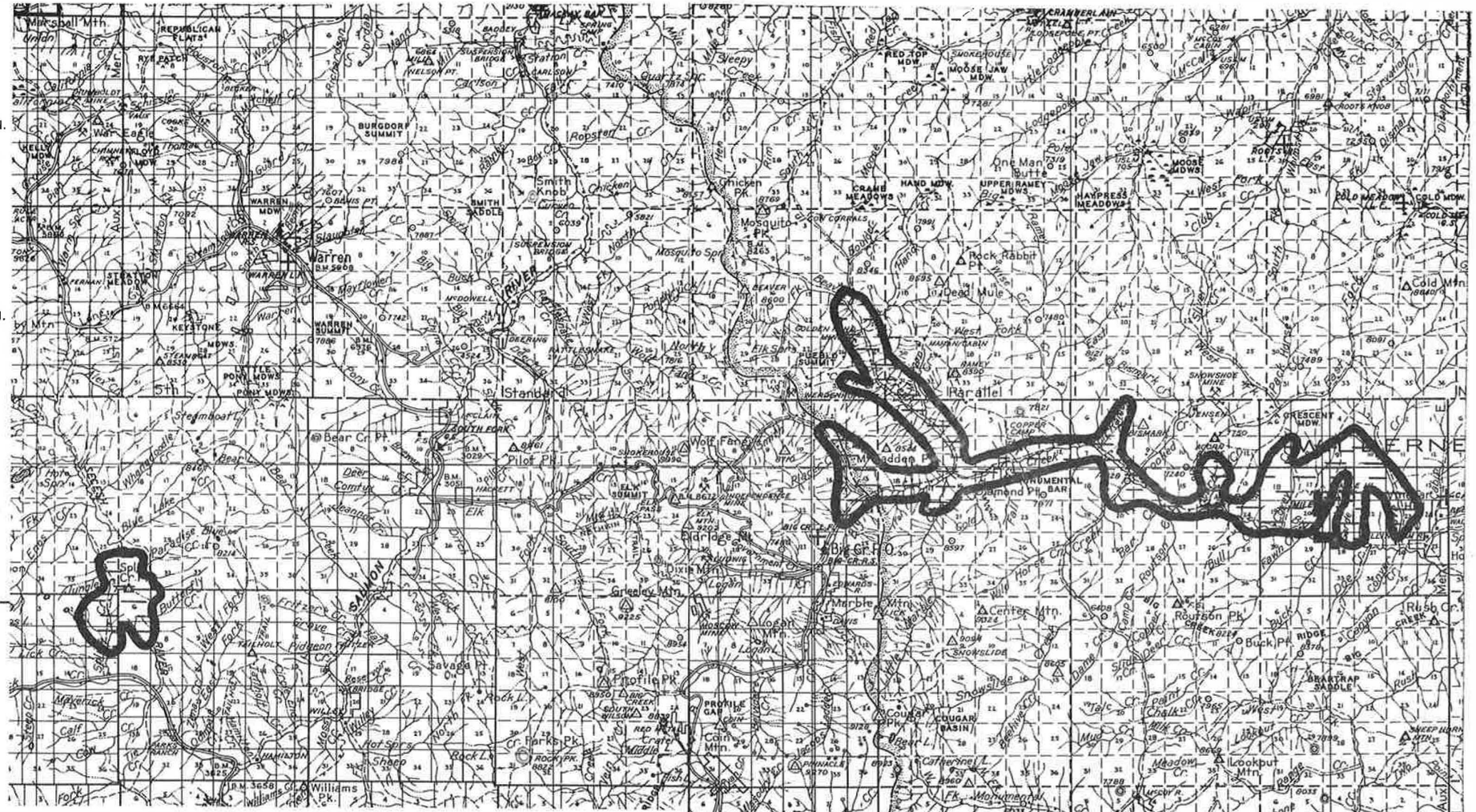
T.22N.

T.21N.

T.20N.

T.19N.

T.18N.



PAYETTE NATIONAL FOREST

EAST DIVISION

IDAHO

INSECT INFESTATIONS 1953 - 1954

AREA

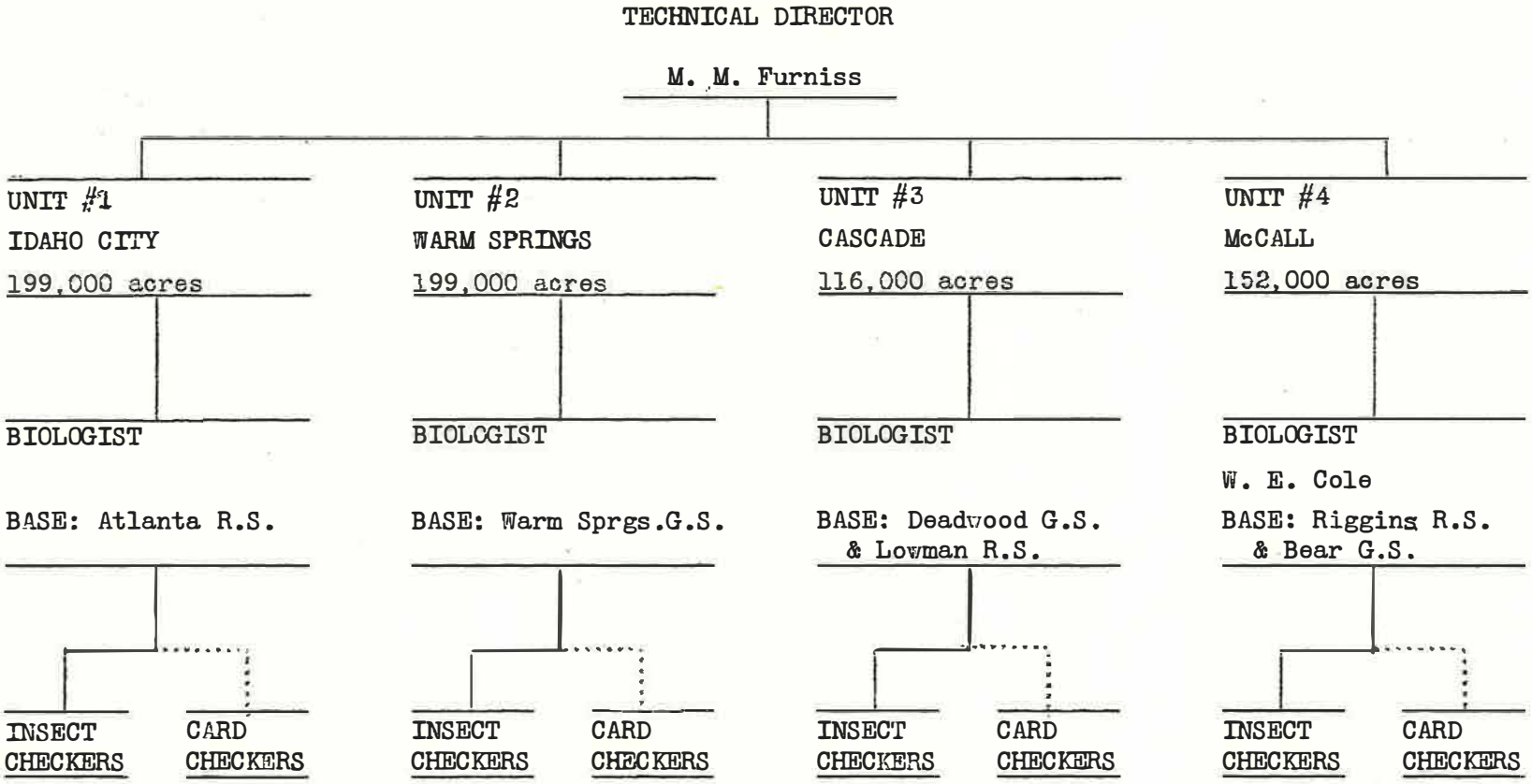
LEGEND

SPRUCE BUDWORM INFESTATION

PINE BUTTERFLY INFESTATION

STATE OWNERSHIP

PRIVATE OWNERSHIP



Note - Insect Checkers and Card Checkers are hired and financed by Administration. Insect Checkers are directly responsible to Biologists. Card Checkers are directly responsible to Unit Supervisors but the Biologists will determine the location of sample strips and the Blocks which are to be sampled.

Biologists.

Four Biologists, hired by Research, will be directly responsible to the Technical Director. Each Biologist will be in charge of the biological observations on a control unit. The duties of the Biologist are:

1. To become thoroughly familiar with his control unit including roads, trails, elevational zones, boundaries of the unit, spray block boundaries, etc.
2. To instruct the Insect Checkers in the methods of making daily collections of larval material.
3. To select the spots for daily collections by the Insect Checkers.
4. To determine the rate of larval development by measurements of head capsules according to prescribed standards.
5. To keep detailed records of the progress of larval development by regular collecting spots and other sampling spots established in the unit. (Form appended).
6. To secure larval development data in doubtful blocks as a supplement to the data collected by the Insect Checkers.
7. To report to the Technical Director on a weekly schedule as to the rate of larval development with said reports to reach him by Monday of the following week.
8. To advise the Unit Supervisors in writing as to the timing and sequence of spraying operations on each spray block within the unit. The Technical Director will consult with the Biologists as to priorities for spraying and the need for special spot checks in doubtful spray blocks.
9. To assist in establishing representative lines for sampling larval populations one or two days before spraying and to assist in rerunning the same lines 10 days after spraying.
10. To keep detailed records on the "Larval Mortality Count" form (sample appended) for each mortality line.
11. To select the blocks and lines which will be sampled for adequacy of spray deposit.
12. To cooperate with the Unit Supervisor and his assistants in checking larval mortality in blocks, where spray deposit cards show an inadequate coverage, in order to determine the need for respraying.
13. To keep daily records of the blocks or portions of blocks released for spraying, the progress of spraying and other records for each unit. The total acreage in each block and the daily sprayed acreage should be obtained from the Unit Supervisors.

Insect Checkers.

Sixteen Insect Checkers, hired by Administration, will be directly responsible to the Biologist in their respective control unit. The duties of the Insect Checkers are:

1. To become thoroughly familiar with the control unit - roads trails, elevational zones, unit boundaries, spray block boundaries, etc.
2. To make daily collections of budworm larvae and observations on the development of foliage at designated points as instructed by the Biologist within each unit.
3. To deliver the daily collections to the Biologist.
4. To assist in the establishment of representative mortality lines in selected spray blocks one or two days prior to spraying as instructed by the Biologist.
5. To rerun the same lines 10 days after spraying.

Card Checkers.

Eight card checkers, hired by Administration, will be directly responsible to the Unit Supervisors. However, Research personnel will determine the location of spray deposit sampling lines and will explain the use of deposit-standard booklets. In the event that some spray deposit cards indicate inadequate spray application, a biologist will examine the area in question and determine the need for re-spraying. The major duties of the Card Checkers are:

1. To distribute one spray deposit card every 5 chains along a designated course one day before the area is sprayed.
2. To collect the same spray deposit cards within one day after spraying.
3. To evaluate the rate of application received on the spray deposit cards. This is done by visual comparison with a deposit-standard booklet.
4. To report to the Unit Supervisor any areas which have not received adequate spray as indicated by the spray deposit cards. The Unit Supervisor will then notify the Biologist who will investigate.
5. To assist the Biologist in determining the extent of the area missed by spray or the need for re-spraying.

DAILY COLLECTION OF LARVAL SAMPLES

The daily collection and measurement of samples of budworm larvae and observations of foliage development are the bases for determining the rate of larval development and the start and sequence of spraying operations in each unit and block. This is a most important task and the procedures listed below will be followed by the Biologists and Insect Checkers:

1. The Biologists will determine, if possible, the dates on which the budworm breaks hibernation at low, medium and high elevations

in each control unit. Observations should be made on key trees at several exposed points in each unit to determine the date on which the tiny second instar larvae are seen on the needles or the first needle mining is noted. This date will be close to the date at which hibernation ended.

2. The Biologists will establish representative collection spots at low, medium and high elevations for each Insect Checker. Daily collections should be made from these points up to the time of spraying. In some cases, collections will be made on alternate days if two or more sets of such spots are established for the Insect Checker.

3. Daily collections should begin when the larvae have entered the buds. Other sampling points should be established and spot checks made in as many blocks as possible to obtain as much data on larval development as possible. A tabulation of the collecting points should be prepared by the Biologist, showing the spray block, sample line, and collection point. All collecting points should be located on a map of the unit.

4. At each collecting point, 100 larvae should be collected, except during spot checks when 50 larvae at a spot should be collected. Several fifteen-inch branches should be carefully clipped and placed on a collecting cloth. Each bud should be examined and all live larvae or pupae collected and counted as part of the sample. When 100 larvae have been collected, the cloth should be examined and any larvae on the cloth should be added to the sample.

5. Larvae should be placed in a vial containing 70% alcohol and labeled as to date, collector, collection point, block number and unit.

6. Each daily collection should be delivered to the Biologist when the field work is finished for the day. As the time for spraying approaches, it is most important that the material reach the Biologist just as soon as possible.

RELEASE OF SPRAY BLOCKS FOR SPRAYING

To be fully effective, control of the spruce budworm by the aerial application of DDT insecticide must be critically timed during the 10 - 14 day period, in any one elevational zone, when the larvae are exposed and vulnerable. Control is not effective when the larvae are: (1) mining the needles during the second instar, (2) protected by the tight or swollen bud scales during the second and third instars, and (3) in the pupal stage. Therefore, control is directed against the fourth, fifth and sixth instars; preferably before too many reach the sixth instar. A larval development chart for a project in Oregon has been included in the Appendix, for reference purposes only, to give the Biologists an idea of the rate of larval development. Because no control project has been conducted against the spruce budworm in southern Idaho no better information concerning development is available. However,

gross differences between development in Oregon and Idaho may be anticipated. For example, the calendar dates shown in the table are thought to be much too early for Idaho. The following guides will be used by the Biologists in determining when an individual spray block or group of spray blocks should be released to the Unit Supervisor for spraying:

1. Head-width measurements of daily collections of 100 larvae from designated collecting points, supplemented by spot checks of 50 larvae and observatios on foliage development, will be the bases for determining when entire spray blocks or parts of blocks are to be released for spraying. These measurements are to be made and tabulated daily by the Biologist. With a little experience it should be possible to segregate 100 larvae in less than an hour by comparison with a set of standards preserved in alcohol. Doubtful larvae can be measured in order to determine the instar to which they belong. Plans have been made to construct a table of larval head-width measurements to aid the Biologists' classification of doubtful larvae. The table will be made available when it is completed.

2. When the percentage of third instar larvae approaches 10-15%, the start of spraying operations is about 10 days away. (Quite often this percentage of third instar larvae will fluctuate for several days around the 10% level and then drop to 5% or below.) When this happens the Unit Supervisor should be notified in writing that all spray planes assigned to the control unit should be ordered to the airfield and that spraying operations will probably start on a given date. The Technical Director will assist the Biologist in setting these dates.

3. Blocks are usually ready to be released for spraying when the percentage of larvae in a daily collection is in the following general proportions:

2nd Instar	=	None
3rd Instar	=	1 - 5%
4th Instar	=	40 - 45%
5th Instar	=	45 - 50%
6th Instar	=	1 - 5%

4. Foliage development should be fairly uniform throughout a block before it is released for spraying. All bud scales should be thrown off, the current foliage should be unfurled and the terminals should be an inch or more in length.

5. When larval and foliage conditions are not uniform in an entire block, it will be necessary to: (1) split the block so as to spray those portions that are ready, or (2) withhold spraying until conditions are uniform throughout the block, at which time 50% or more of the larvae may be in the sixth instar. The length of time that the larvae have been in the sixth instar and the daily temperatures will largely determine how long portions of a block can be held safely before release.

6. The Biologist should work closely with the Unit Supervisor in setting the priorities for spraying and in splitting blocks when this is necessary. The technical Director may assist the Biologist in making these decisions.

ESTABLISHMENT OF MORTALITY LINES

While it may not be possible to establish a mortality line in every spray block to determine the results of spraying during the project, an attempt should be made to sample as many blocks as possible. The following procedures should be followed in establishing these important lines:

A. BEFORE SPRAYING

1. One or two days before a block is to be sprayed a mortality line will be established by the Biologist and Insect Checkers.

2. The Biologist should determine from the Unit Supervisor and the Chief Pilot the spraying pattern for a particular block. If possible, the mortality line should be established perpendicular to the spray pattern. Roads and trails may be used so as to expedite the establishment of mortality lines.

3. A mortality line should consist of ten sampling stations. Each station should be 5 chains apart, if the distances are paced; or 0.2 miles apart, if established along roads.

4. At each station, two 15-inch branches should be clipped carefully from each of 5 trees. The branches should be placed on a collecting cloth and every bud examined. All live larvae and pupae should be counted and placed in a vial containing 70% alcohol. The number counted should be recorded on the Larval Mortality Count form.

5. The Biologist should determine the percentage of budworm in each instar class for the first 100 larvae of the above collection. These percentages should be recorded as the final collection in the block.

6. In large blocks two or more mortality lines may be desirable. The number of lines per block will be determined by the Biologist and the Technical Director.

7. All mortality lines should be numbered and located on a map of the unit.

B. AFTER SPRAYING

1. Ten days after spraying, the same lines will be rerun by the same men.

2. At each sampling station, twenty 15-inch branches (four branches from each of five trees) should be clipped, carefully placed on a collecting cloth and examined for surviving larvae, pupae, and pupal cases. All such material should be saved in vials containing 70% alcohol.

3. The data so obtained are to be entered on the "Larval Mortality Count" form and the percentage mortality computed as shown on the form.

REPORTS FROM BIOLOGISTS

The following reports should be prepared by the Biologist:

1. Weekly Progress Report: A brief, informal summary of the rate of budworm development by instars and collecting points; start, progress and end of spraying operations; general climatic conditions and other pertinent information concerning the project. Any difficulties that arise should also be included as well as supplies or equipment needed. Address these reports to the Technical Director. Reports should be prepared and mailed so as to reach him by Monday of the following week.

2. Bi-Weekly Time Report: One copy of Form FS-26 should be completed by each Biologist and mailed directly to Ogden at the end of each pay period.

3. Monthly Expense Account: At the end of every month, a summary of the per diem account, purchases and miscellaneous expenses should be submitted to Ogden. The account will then be typed and returned to the biologist for checking and signature before it is submitted for payment.

4. Automobile Report:

   (a) Gasoline Receipts: If the vehicle is provided by the Experiment Station, all receipts for gasoline, oil, grease jobs, etc. should be submitted bi-weekly with the Time Report. All purchases should be entered in the car book at the time of purchase. If the vehicle is provided by Administration, other appropriate procedure will be specified.

   (b) Monthly Operation Report: At the end of each month, a report of mileage and operational costs should be submitted.

APPENDIX

Appendix A

Equipment for Technical Personnel

I. Transportation.

Assignment of vehicles will be made at a later date.

II. Field and Office Equipment and Supplies.

The following equipment and supplies will be provided the biologists and insect checkers in the quantities indicated:

Field Equipment	Biologist	Insect Checker	Total
Compass, pocket	1	1	21
Brush, camel's hair	1	1	21
Hand pruning shears	1	1	21
Collecting cloth (3' x 3')	1	1	21
Dissecting needle	1		4
Glass vials & corks			
24 x 95 mm.	1 gross	2 doz.	8 gross
10 x 75 mm.	1 gross	2 doz.	5 gross
Tally register	1	1	21
Tree tags	100	200	3000
Forceps	1	1	21
Alcohol (70%)	1 gal.		5 gal.
Altimeter	1		5
Binocular microscope	1		4
Flashlight	1	1	21
Eyedropper	1		4
Scalpel	1		4
Larval instar standards	1		4
Tatum (8 x 10)	1		4

Field Equipment	Biologist	Insect Checker	Total
Petri dish	1		10
Canvas carrying bag	1	1	21
Quart jar	2		12
String	2	2	50 cones

Office Supplies	Biologist	Insect Checker	Total
Control unit maps	4	2	50
Control unit photo mosaic	1		5
U. S. Forest Service note book	1	1	24
U. S. Forest Service diary	1		500 sheets
Form FS-26 (Time report)	6	6	150
Pencils	4	4	72
Scratch pads	2	2	48
Form, larval development	50		300
Form, larval mortality	50		300
Franked envelopes (4x9½")	50		200
Stationery (8x10½")	50		200
Paper clips	1 box		4 boxes
Form SF-44 (Purchase order book)	1		4
Scotch tape	1 roll		4 rolls

III. Communication.

Adequate means of daily communication between the Technical Director and Biologists will be provided.

Appendix B

EXAMPLE OF SPRUCE BUDWORM LARVAL DEVELOPMENT
PRIOR TO START OF AERIAL SPRAYING
UKIAH UNIT, 1950 CONTROL PROJECT

Collection Point - Dale Ranger Station Elevation - 2900 feet
Collector - E. Hooven

Collection Date	Larval Instars (% of Daily Collection) 2	3	4	5	6	Pupae	Total Larvae Collected
6/2	52	40	8				100
6/3	23	55	21	1			100
6/4	8	78	13	1			100
6/5	12	59	25	4			100
6/6	2	59	40	0			100
6/7	20	46	27	7			100
6/8	7	22	58	13			100
6/9	1	26	69	4			100
6/10		11	74	15			100
6/11		12	65	23			100
6/12		28	62	10			100
6/13		12	54	34			100
6/14			15	85			100
6/18			15	75	10		100
6/21			16	52	32		100

6/11 Notice given to Unit Supervisor that spraying operations would probably start in 10 days.

6/21 Start of spraying operations

Note - Spraying operations could have started a day or two sooner but were postponed until 6/21 in order that more of the block at higher elevations would be ready for spraying after the low elevations were treated.

Appendix C

SPRUCE BUDWORM LARVAL DEVELOPMENT RECORD

Forest _____ Unit _____ Spray Block _____

Collection Point _____ T. _____ R. _____ Section _____ Subdivision _____

Elevation _____ Exposure _____ Topographic Position _____

Date Block Ready for Spraying _____ Date Block Sprayed _____ Collector _____

Collection Date	LARVAL INSTARS										PUPAE		Total
	2		3		4		5		6				
	No. Larvae	%	No. Larvae	%	No. Larvae	%	No. Larvae	%	No. Larvae	%	No.	%	

Appendix D

LARVAL MORTALITY COUNT NO._____

Forest _____ Control Unit _____ Spray Block _____

Starting Point _____ Direction Run _____

Block Released_____ Block Sprayed _____ Pilot _____ Plane _____

BEFORE SPRAYING

Date Examined_____ Collector_____

AFTER SPRAYING

Date Examined____ Collector ____

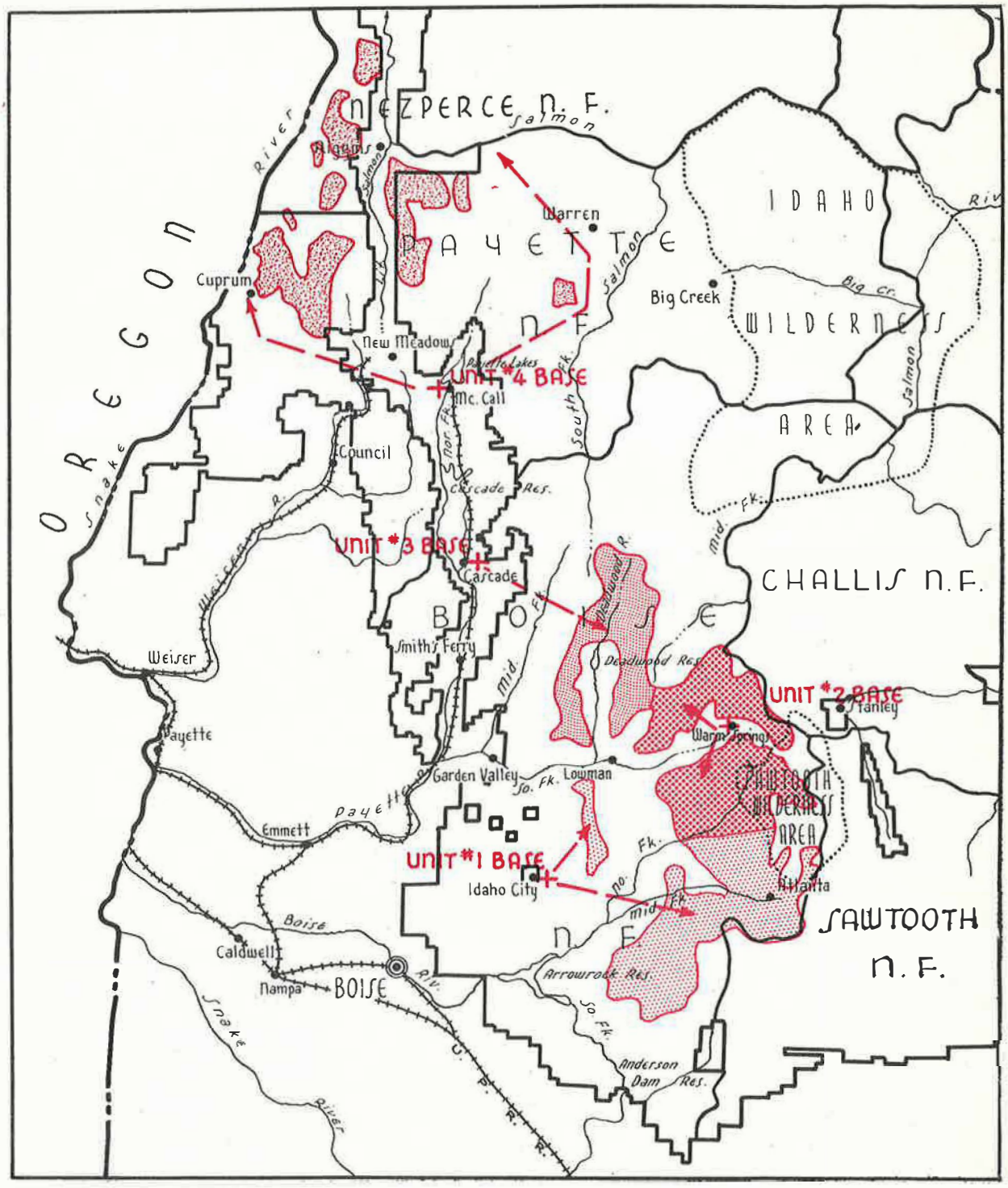
Sample No.	Tree Sp.	Dist. Next Sample	No. of Bran-ches	Branch Length	Number of Live Larvae	Number of Live Pupae	No. of Bran-ches*	Branch Length	Number of Live Larvae	Number of Live Pupae	Number of Emerged Pupae
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
							--				
Total	-	-		-				-			
Total	-	-		-				-			

* The number of branches examined After Spraying will be twice the number examined Before Spraying.

Percent Mortality = $\frac{[(\text{Pre-Spray Count X 2}) - \text{Post Spray Count}]}{(\text{Pre-Spray Count X 2})}$ X 100 = _____ %

Before Spraying Count - %

2 3 4 5 6 Pupae



SPRUCE BUDWORM CONTROL PROJECT

SOUTHWESTERN IDAHO

BOISE, PAYETTE AND NEZPERCE NATIONAL FORESTS

1955

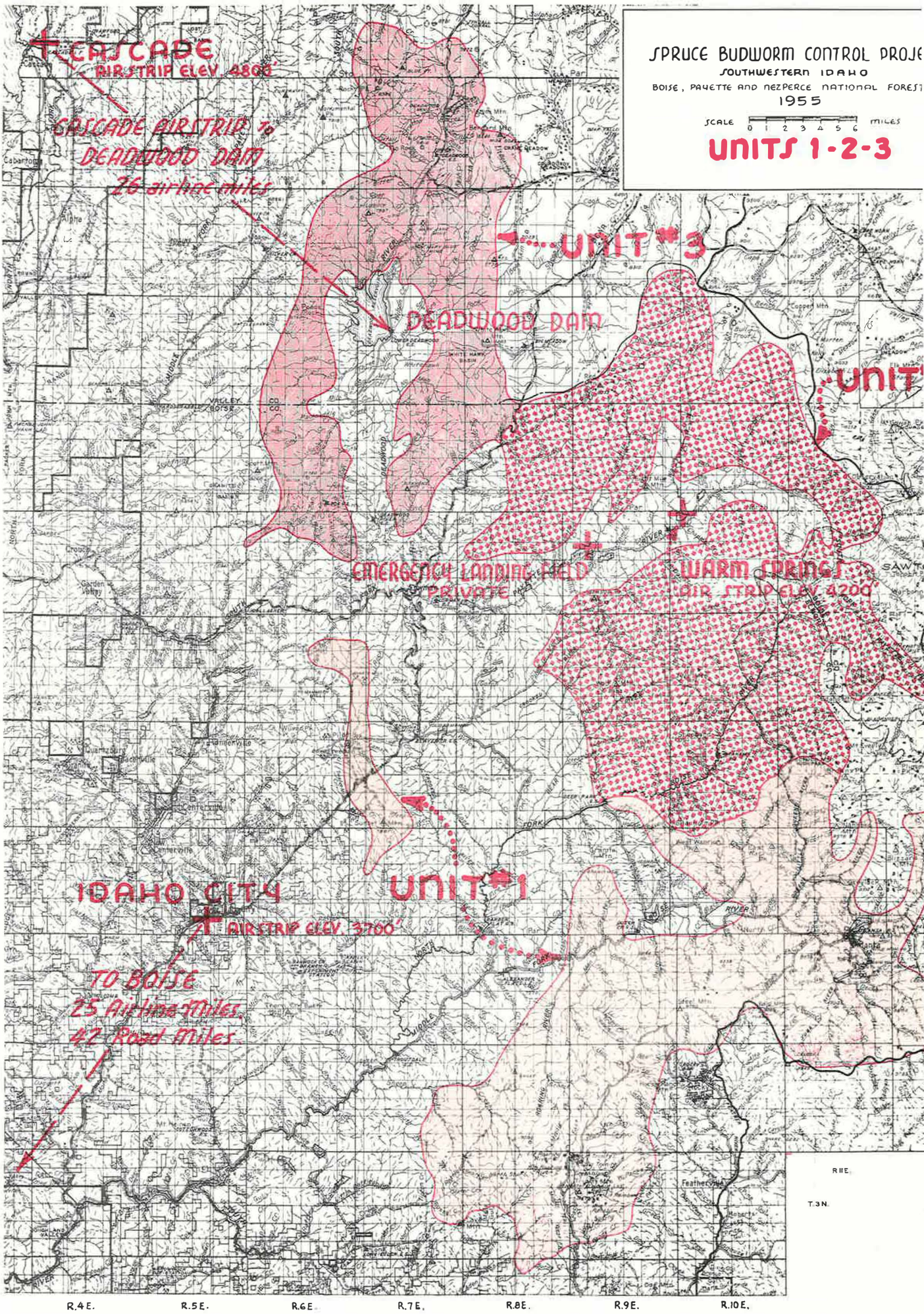
SCALE 0 10 20 30 40 MILES

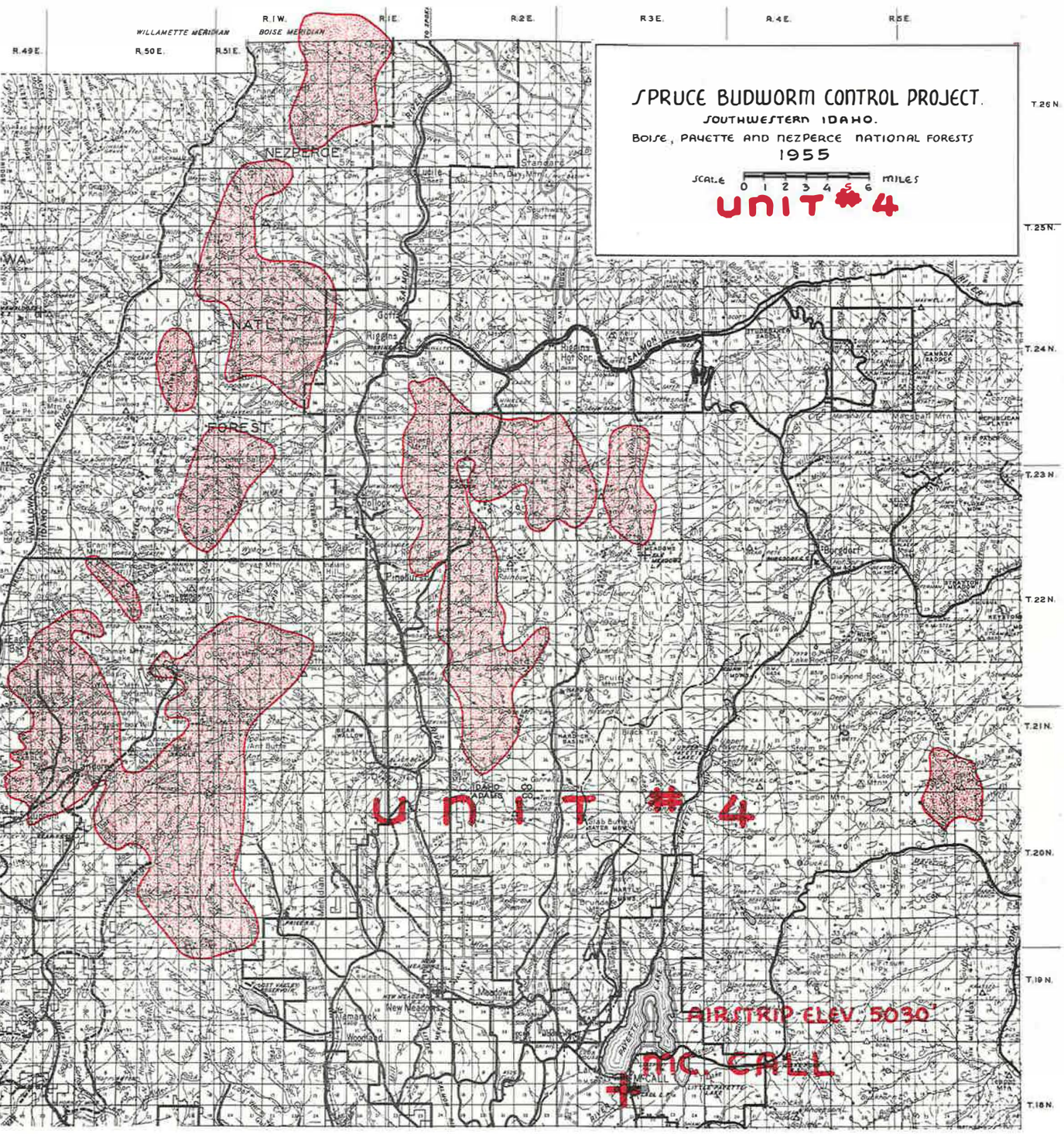
LEGEND

Control Areas

+ Base Landing Field or Airstrip.

U.S.F.S. Ogden, Mar. 1955.


SPRUCE BUDWORM CONTROL PROJE
SOUTHWESTERN IDAHO
BOISE, PAYETTE AND NEZPERCE NATIONAL FOREST
1955
SCALE 0 1 2 3 4 5 6 MILES
UNITS 1-2-3
CASCADE
AIRSTRIP ELEV. 4800'
CASCADE AIRSTRIP to DEADWOOD DAM 26 airline miles
UNIT #3
DEADWOOD DAM
UNIT
EMERGENCY LANDING FIELD PRIVATE
WARM SPRINGS AIR STRIP ELEV. 4200'
UNIT #1
IDAHO CITY
AIRSTRIP ELEV. 3700'
TO BOISE 25 Airline Miles, 42 Road miles
R.4E.
R.5E.
R.6E.
R.7E.
R.8E.
R.9E.
R.10E.
R.11E.
T.3N.


SPRUCE BUDWORM CONTROL PROJECT.
SOUTHWESTERN IDAHO.
BOISE, PAYETTE AND NEZPERCE NATIONAL FORESTS
1955
SCALE 0 1 2 3 4 5 6 MILES
UNIT # 4
WILLAMETTE MERIDIAN
BOISE MERIDIAN
R.49E.
R.50E.
R.51E.
R.1W.
R.1E.
R.2E.
R.3E.
R.4E.
R.5E.
T.26N.
T.25N.
T.24N.
T.23N.
T.22N.
T.21N.
T.20N.
T.19N.
T.18N.
NEZPERCE
NATL
FOREST
UNIT # 4
AIRSTRIP ELEV. 5030'
MC CALL